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APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

ENGINE COVER PULLER

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BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The present invention relates to a device for facilitating the separation and removal of an engine cover from a sealing surface on an engine. The present invention may reduce or eliminate the deformation of an engine cover during its removal and allows for its potential reuse. In addition, the present invention may reduce or eliminate the damage to the sealing surfaces between the engine cover and the engine that may occur during an engine cover removal.

[0002] A typical engine cover removal, such as the removal of a valve cover from a cylinder body, usually requires breaking a seal between the cover and the engine. This task, absent the use of the present invention, typically involves the mechanic inserting an item, such as a flat blade screwdriver, between the cover and the engine. Once the screwdriver is inserted, the mechanic pries the cover from the sealing surface on the engine. This can result in damage to the sealing surfaces between the cover and the engine. Occasionally, the damage is minimal such that a seal between the cover and engine can be reestablished upon assembly of the parts into a surface-to-surface contact of the sealing surfaces. On other occasions, a gasket or sealant is required to obtain a seal between the cover and the engine. On yet other occasions, one or both of the sealing surfaces must be restored by

machining/surfacing operations. And, on other occasions, the damage to the sealing surfaces during the removal of the cover results in the required replacement of one or more parts in order to obtain a seal between a cover and an engine.

[0003] A vast number of covers used on engines are comprised of stamped material or composites such as metals and plastics. While such materials are adequate for their installed function as a cover, the covers may be susceptible to damage during removal operations such as described previously. In addition to sealing surface damage as described above, typical damage to the covers may include permanent deformation and cracking. As a result, a mechanic may have to spend excessive time attempting remedial measures that do not always result in successful solutions such as reshaping the deformed cover or using an excessive amount of sealant that may be susceptible to damage or subjected to undesirable environmental conditions. On many occasions, the only viable solution for a mechanic may be to replace the damaged cover with a new cover or a used cover in suitable condition. However, sometimes a replacement cover is not obtainable within the time constraints of the job. For example, the device using the engine, such as an automobile, may not be movable until the cover has been replaced. In the meantime, the automobile might occupy a mechanic's work area or a vehicle lift. On other occasions, the cover may have been removed to perform emergency repairs in a remote location. As a result, despite the repair having been completed, the engine may be inoperable until a replacement cover is obtained and installed.

[0004] The device of the present invention facilitates the separation and removal of an engine cover from a sealing surface on an engine. The present invention is an apparatus to allow an operator to provide a separation force via the movement of a lever arm to move a puller arm engaging an engine cover that will be sufficient to separate the engine cover from a sealing surface on an engine. The mechanical advantage provided by the present invention may be configured by modification of the length of the lever arm and/or the position of the mounting locations for either or both of the base and puller arm elements of the present invention. The present invention may be used to minimize or eliminate the bending of the cover during its removal from the engine. The present invention may provide a complementary surface for engaging an engine cover that adequately distributes the force applied as might be required to break the seal between the cover and the engine. The present invention may prevent or eliminate the potential for damage to the sealing surfaces between an engine cover and an engine.

[0005] The present invention comprises a device having a base used to contact a portion of an engine cover to be removed from an engine. The base may be shaped to provide a complementary fit with the engine cover. The fit between the base and the engine cover may also allow the distribution of a stabilizing force that is generated as a result of the movement of the lever arm of the present invention.

[0006] The present invention also includes a lever arm that is typically pivotably connected to the base. The base is typically connected on one end of

the lever arm. The lever arm is preferably moved by a user to cause a typically pivotably connected puller arm to move while the puller arm is engaged to an engine cover. The movement of the puller arm then causes the engine cover to separate from the sealing surface on an engine.

[0007] Embodiments of the present invention may include channels or shaped elements on the puller arm in order to provide complementary engagement of the puller arm to the engine cover. As a result, the desirable distribution of a separating force to separate the cover from the sealing surface on the engine may prevent, minimize, or eliminate the deformation of the cover as it is separated from the engine.

[0008] An example use of the device of the present invention would involve the positioning of the puller arm so that it adequately engages at least a portion of the engine cover. Typically the puller arm would engage the lower surface or an underside of the cover. Then, the base of the present invention would be positioned on another portion of the cover. Typically this portion would be on an upper surface of the cover. As stated earlier, the base may be complementary shaped so as to allow for the distribution of a stabilizing force that is generated when the lever arm is moved. After engagement of the cover by the puller arm and placement of the base on the cover, the lever arm is moved to separate the cover from the engine. A separating force may have to overcome a seal between the cover and the engine. The separating force applied by the device of the present invention can be affected by either the length of the lever arm or the locations of attachment for the typically pivotably attached puller arm

and base. Sometimes, the application of the separating force can be a factor in facilitating the breaking of a seal between the cover and the engine. For example, a sharp or quick application of force may be applied via use of the device of the present invention in order to break the seal between the cover and the engine.

[0009] Examples of typical engine covers that may be removed with the use of the present invention include, but are not limited to, a valve cover, a case cover, a dust cover, and an engine pan.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In addition to the novel features and advantages mentioned above, other objects and advantages of the present invention will be readily apparent from the following descriptions of the drawings and preferred embodiments.

[0011] Figure **1** is a perspective view of an embodiment of the apparatus of the present invention.

[0012] Figure **2** is a side elevational view of an embodiment of the apparatus of the present invention.

[0013] Figure **3** is a view showing a portion of an embodiment of the apparatus in operation.

[0014] Figure **4** is a view showing a portion of an embodiment of the apparatus in operation.

[0015] Figure **5** is a view showing a portion of an embodiment of the apparatus in operation.

[0016] Figure **6** is a view showing a portion of an embodiment of the apparatus in operation.

[0017] Figure **7a** is a perspective view of an embodiment of a portion of the present invention.

[0018] Figure **7b** is an elevational view of an embodiment of a portion of the present invention.

[0019] Figure **7c** is a perspective view of an embodiment of a portion of the present invention.

[0020] Figure **7d** is a perspective view of an embodiment of a portion of the present invention.

[0021] Figure **7e** is a perspective view of an embodiment of a portion of the present invention.

[0022] Figure **8** is a side elevational view showing a portion of an embodiment of the apparatus in operation.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENT(S)

[0023] One embodiment of the engine cover puller of the present invention can be seen by reference to **Figures 1** and **2**. As can be observed, the engine cover puller **10** is comprised of a base **20**, a lever arm **30**, and a puller arm **40**. The base **20** and puller arm **40** are shown pivotably connected to the lever arm **30** at **21** and **41**, respectively. In this manner, the pivotable

connections at **21** and **41** allow for placement of the base **20** and the engagement of the puller arm **40** to achieve and maintain an alignment with a cover to be removed during a substantial portion of movement of the lever arm **30** to effect the separation of an engine cover from a sealing surface with an engine. In other words, the lever arm **30** is pivotably mounted to the base **20** at **21** so that the lever arm **30** may pivot about a first axis. Concurrently, the lever arm **30** is pivotably mounted to the puller arm **40** at **41** so that the lever arm **30** pivots about a second axis that is spaced from the first axis.

[0024] Also shown on **Figures 1** and **2** is a channel **42** on the puller arm **40**. The channel **42** in the example embodiment is shaped so as to provide a complementary fit with the lip on the lower surface of an engine cover. The channel may be a single channel or it may be multiple channels. It is not required that the channels be in any particular alignment. Instead, it is preferred that the shape, location, and number of channels on the puller arm **40** should be dictated by the arrangement that is advantageous to the particular application to provide a suitable contact surface with the engine cover to be removed so that the potential for damage to the cover or the sealing surface is minimized or controlled. This feature of the present invention is not limited to channels. For example, preferred embodiments of the present invention may use cutouts or unique profiles so as to make a complementary engagement with an engine cover to be removed. In addition, the puller arm may have holes or studs to accommodate a simple attachment to an engine cover to be removed with a version of the present invention.

[0025] Portions of an embodiment of the engine cover puller of the present invention in operation can be seen by reference to **Figures 3, 4, 5,** and **6.** As can be observed in **Figure 3**, the base **20** of an engine cover puller **10** is shown in contact with the upper surface of a valve cover **51** of an engine **50**. **Figure 3** also shows a spark plug at **52**. As can be observed, the base **20** has a groove **22** that allows for the base **20** to be placed in a complementary fit with a portion of the surface of the valve cover **51** by surrounding a portion of the periphery around the spark plug **52**. Also shown is the pivotable connection **21** between the base **20** and the lever arm **30**.

[0026] As can be observed in **Figure 4**, a portion of the lower surface **53** of the valve cover **51** and, in particular, the lip at **54** is shown in engagement with a portion of the pulling arm **40**. As can be seen in **Figure 4**, the versatility of shapes for the pulling arm **40** allows for a portion of the pulling arm **40** to be cut away to allow for the additional overhanging portion **55** of the lip **54** of the lower surface **53** of the valve cover **51** to remain undamaged during the removal operation of the cover **51**.

[0027] As can be observed in **Figures 5** and **6**, the engine cover puller **10** is shown with the base **20** in contact with the upper surface of the valve cover **51** and the puller arm **40** engaged to the lip **54** of the valve cover **51**. As is evident from **Figures 5** and **6**, the engine cover puller **10** is used to separate the valve cover **51** from the engine **50** when the lever arm **30** is moved to generate a sufficient separation force to pull the cover **51** from the sealing surface of the engine **50**. **Figure 5** shows the engine cover puller **10** in contact and engaged to

the valve cover **51** just prior to the movement of the lever arm **30**. **Figure 6** shows the resultant separation of at least a portion of the cover **51** from a sealing surface of the engine **50**. As may be observed in **Figure 6**, the cover **51** has been lifted relative to the engine **50**. In addition, it should be appreciated that the pivotable connections **21** and **41** allow the base **20** and puller arm **40** to remain in alignment with their respective contact and engagement surfaces with the cover **51** as the lever arm **30** and the puller arm **40** pivot about separately spaced first and second axes, respectively.

[0028] As can be observed in **Figures 7a, 7b, 7c, 7d,** and **7e**, perspective and elevational views of portions of an example embodiment are shown and identified as a base **70**, lever arm **80**, puller arm **90**, and pivot pins **100** and **101**. Some of the features of the example embodiment of the portions of the present invention include an exemplary shaped bottom surface **71** of the base **70** as shown in **Figure 7a**. The shaped bottom surface **71** is intended to provide a complementary fit with an intended cover to be used with this particular embodiment of the present invention. Also shown on the elevational view of the base **70** at **Figure 7b** is an example cutout portion **72** of the base **70** to accommodate the intended cover for this embodiment. As shown at **Figure 7c**, an example embodiment of the lever arm **80** is shown with holes **81** and **82** to accommodate the pivot pins **100** and **101** of **Figure 7d** to be used for the pivotable connections of the lever arm **80** with the base **70** and puller arm **90**. As shown at **Figure 7e**, an example embodiment of the puller arm **90** is shown

having a channel **91** to be used for the complementary engagement of the intended cover for this particular embodiment.

[0029] **Figure 8** is a detailed illustration of an exemplary embodiment of a portion of the present invention in operation. **Figure 8** shows a channel **91** of a portion of a puller arm **90** engaged to a portion of an engine cover **92**. As shown at **93**, the channel **91** provides a complementary fit to the portion of the engine cover **92**. Preferred embodiments of the present invention do not require the fit between a cover and a channel, or another portion of the puller arm, to be held to close tolerances. Instead, it is preferred, for some embodiments of the present invention, that an engagement between a puller arm and an engine cover need only be adequate to allow the use of the apparatus of the present invention to transfer a force sufficient to separate a cover from the remainder of an engine. Alternatively, other embodiments of the present invention may have a close tolerance engagement or fit between the puller arm and a cover. Such close tolerance engagements may be desired for embodiments tailored for specific cover removal applications.

[0030] Preferred embodiments of the present invention may operate as a second class lever. The system of the second class lever is characterized by a fulcrum located in the vicinity of a first end of a lever and a force located in the vicinity of a second end of the lever. The load of the second class lever is located between the fulcrum and the force. Another typical characteristic of a second class lever is that the load is moved in the same direction as the applied force. As shown in preferred embodiments of the present invention, the base in

contact with an engine cover to be removed would be considered the vicinity of the fulcrum of a lever. The end of the lever arm opposite its pivotable attachment to the base would be the general vicinity of the application of a force, such as would be applied by a user of an embodiment of the present invention. Between the application of the force on an end of the lever arm and the pivotable connection with the base in contact with a cover on the opposite end of the lever, the puller arm is engaged to the cover to be removed. As a force is applied to the lever arm, a separating force is generated as the puller arm engages the cover and displaces the "load" by removing the cover from at least a portion of a sealing surface between the cover and the engine.

[0031] The preferred embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The preferred embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described preferred embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.